

REMARKSIN THE CLAIMS

Applicant respectfully requests that claims **13 – 16** be canceled without prejudice and that Claims **12, 19** and **20** be amended as shown below.

CLAIM 12 IS AMENDED AS FOLLOWS

In original line 2 of the claim, the word -- first -- is ADDED BEFORE the word “thickness” in order to distinguish this element from a later identified element “thickness”; and the words “surfaces” is DELETED and replaced with the word -- surface --, in order to correct it spelling. Support is found in page 9, lines 10 – 15 and the inherency of FIG. 3.

In original line 3 of the claim, the words and clauses:

“...said silicon substrate comprising one or more open cavities etched into said top surface and extending into said substrate thickness, each of said one or more open cavities having one or more surfaces wherein some of said surfaces are non-prismatic surfaces, said surfaces extending to different depths into said substrate thickness said open cavities filled with a metal deposit to provide a plurality of metal structures embedded into said silicon substrate ...”

AFTER the words “a silicon substrate having a” and BEFORE the period ending the sentence, are DELETED and REPLACED with the words and clauses:

-- a three-dimensional metal structure embedded into said silicon substrate and about flush with said top surface, said three-dimensional metal structure comprising a second thickness less than said first thickness, and one or more regions, wherein said second thickness varies continuously across a length and width of said three-dimensional metal structure thereby providing a floor surface in each of said one or more regions which varies in a curvilinear manner. --.

The change is made to provide better describe the invention. Support for -- a three-dimensional metal structure embedded into said silicon substrate and about flush to said top surface -- is found at page 3, line 15; page 8, line 25; page 14, line 25; original claim 12; and FIG. 3 of the

written description. Support for -- said three-dimensional metal structure -- is found in the title of the application, and in the written description on page 1, line 13; page 3, lines 6, 10, and 13; and page 4, lines 25 -- 26. Support for -- comprising a second thickness less than said first thickness -- is found in the inherency of FIG. 3. Support for -- one or more regions -- is found in the inherency of FIG. 3 and in the written description between pages 9 and 14 which discuss the formation of etched cavities and the metal structure which eventually fills those cavities. Support for -- wherein said second thickness varies continuously across a length and width of said three-dimensional metal structure -- is found in the written description at page 5, line 17; and the inherency of the description at page 3, lines 2, 3, and 15 and in FIG. 3. Support for -- thereby providing a floor surface in each of said one or more regions which varies in a curvilinear manner -- is found at page 13, line 20; page 14, line 1; original claims 10 and 15; and in FIGs. 2B and 3 of the written description.

CLAIMS 13 – 16 ARE CANCELED

CLAIMS 17 – 18 ARE ORIGINAL

CLAIM 19 IS AMENDED AS FOLLOWS

In original line 2 of the claim, the word “first” AFTER the words “vapor deposited” and BEFORE the words “metal layer” are DELETED. The change is made to remove a source of indefiniteness in the claim since there are never any additional metal layers recited as deposited. Support is found in the written description at page 8, line 7; page 14, line 12; and in Figure 2C.

CLAIM 20 IS AMENDED AS FOLLOWS

In original line 1 of the claim, the word -- thin -- is ADDED BEFORE the words “vapor deposited”; and in line 2 the words “a first layer of” are DELETED. The change is made to remove a source of indefiniteness in the claim. Support is found in the written description at page 8, line 7; page 14, line 12; and in Figure 2C.

CLAIMS 21 – 23 ARE ORIGINAL

No new matter has been added as a result of the forgoing amendments.

**REJECTION UNDER 35 U.S.C §112*****Examiner's §2 – 3***

Examiner has rejected Claims 12 – 23 under 35 U.S.C. §112 as being indefinite for failing to particularly point out and distinctly claim the subject matters which the applicant regards as his invention, in that:

*“ Claim 12 as written only requires one cavity. It is therefore unclear how a plurality of embedded metal structures are formed.*

*It is unclear how trench-like and hole-like, as recited in claim 13, further define an open cavity.*

*It is unclear what is meant by some of the surfaces intersecting to form an edge or corner, as recited in claim 16, as all intersections by definition form an edge.*

*Claims 19 and 20 recite depositing a first metal layer. This is unclear since there are never any additional metal layers mentioned.”*

***Applicant's Response***

Applicant thanks the Examiner for her remarks and agrees with the Examiner's findings that Claims 12, 13, 16, 19, and 20 are unclear. Applicant also apologizes for the lack of clarity in the claims, as written.

Applicant, therefore, has requested that Claims 13 – 16 be canceled and that Claims 19 and 20 be amended, as shown. By making these changes Applicant asserts that the indefiniteness in the remaining claims has been eliminated and respectfully request that the Examiner reconsider and withdraw her rejection of the remaining claims.

**REJECTION UNDER 35 U.S.C §102(B)*****Examiner's §4 – 6***

Examiner has rejected Claims 12 – 17 and 19 under 35 U.S.C. §102(b) as being anticipated by Joshi (U.S. Patent Serial Number 5,757,879). In particular, Examiner asserts that:

*“ Joshi teaches in the background, a prior art x-ray mask. The mask consists of patterned trenches formed in a Si substrate and filled with CVD tungsten (IPPAC Group 6). The trenches are cone shaped with a sloping sidewall and are therefore non-prismatic (curved and triangular). See col. 1, lines 38 – col. 2 line 8.”*

### ***Applicant's Response***

Applicant thanks the Examiner for her remarks but notes that while the journal article to Chou, et al. (*J. Vacuum Science B*, vol. 6, no. 6, Nov/Dec 1988, pp. 2202-2206) referenced by Joshi, et al., ('879) in col. 1 (and attached hereto), describes tapered sidewalls for both etched trenches and viae, it does not teach or suggest an embedded structure having a curvilinear floor surface as does the Applicant's written description and his amended Claim 12. Applicant, however, does acknowledge that, as written, original Claim 12 does not distinguish over Chou, et al. and, therefore, he has amended Claim 12 in order to clarify the structure which he claims as his invention. In doing so Applicant asserts he has thereby distinguish his claim over the disclosure of Chou, et al.

In particular, Claim 12 now recites a three-dimensional metal structure embedded into said silicon substrate wherein the metal structure a thicknesses extending into said silicon substrate, and -- and one or more regions, wherein said second thickness varies continuously across a length and width of said three-dimensional metal structure -- and thereby providing -- a floor surface in each of said one or more regions which varies in a curvilinear manner --.

By amending claim 12 in this manner, Applicant makes clear that it is the floor surface of the embedded metal structure (opposite the top surface of the silicon substrate) that is curved, and not the sidewalls of the structure as shown by Joshi, et al. (referencing Chou, et al.). As such Joshi, et al. (referencing Chou, et al.), neither teaches nor suggests an embedded metal structure having regions where the floor surface in each of said regions "... varies in a curvilinear manner".

Applicant notes, therefore, that, in general, in order to maintain a rejection based on anticipated under §102 the Examiner must provide a single reference that teaches or enables every element of the claim (expressly or inherently) as interpreted by one of ordinary skill in the

art (MPEP §2131). Applicant further notes that while Joshi, et al. (referencing Chou, et al.) might suggest curved, non-prismatic surfaces, the referred to surfaces are not the “floor” surfaces which the Applicant now claims as “curvilinear”. Rather, Joshi, et al. (referencing Chou, et al.) discloses tapered channel sidewalls.

Therefore, because of these differences Applicant asserts that Joshi, et al. (‘879) does not teach every element of the claimed invention, and that the structures shown in Chou, et al. are not the same structure described by the Applicant’s disclosure. As such, Joshi, et al. (‘879) fails as a reference against the Applicant’s invention based on 35 USC §102(b). Moreover, because Claims 17 – 23 depend from Claim 12, now shown to be unique, these claims likewise must be unique since, by definition, dependent claims merely narrow the scope of the independent claim from which it depends.

The Applicant, therefore, respectfully asserts that he has overcome the rejection of Claims 12 – 17 and 19 under 35 U.S.C. §102 by clearly distinguishing his invention over Joshi, et al. (‘879) in that Joshi, et al. (‘879) does not recite every element of the instant claim. Consequently, Applicant respectfully traverses the Examiner’s rejection on the basis of MPEP §2131 and respectfully requests that the Examiner to reconsider and withdraw his rejection and pass this claim to allowance.

#### **REJECTION UNDER 35 U.S.C §103(A)**

##### ***Examiner’s §7 – 9***

Examiner has rejected Claims 12 – 14, 16, and 17 – 23 under 35 U.S.C. §103(a) as being unpatentable over Vlannes (U.S. Patent Serial Number 5,004,673) in view of Brady (U.S. Patent Serial Number 4,436,797): In that Examiner asserts:

*“Vlannes discloses a method for manufacturing surface relief patterns of variable depth. Substrate material 3 including one or more non-prismatic cavities (fig. 5b). The etched substrate is coated with a single or multiple layer material film 5 in order to obtain enhanced optical properties. Examples include Au, Ag, Al, Cu or W deposited in a vacuum chamber or by electrochemical means (fig.5c). A thin layer of chromium may be deposited first in order to improve adhesion. See col.5, 49-col.6, 65. Vlannes is silent on the specific substrate material and does*

*not disclose a silicon substrate. The reference however does disclose that the resulting structure is for use as an optical element. Brady teaches that silicon is a known material used for a substrate in an x-ray mask (col.1, 36-48). It would have been obvious to one of ordinary skill in the art to use a silicon substrate for the optical element in the method of Vlannes because Brady teaches that silicon is a known material for use as a substrate for an x-ray mask."*

### ***Applicant's Response***

Regarding Claims 12 – 14, 16, and 17 – 23, Applicant again thanks the Examiner for her remarks but respectfully disagrees with her conclusion.

Applicant notes Vlannes ('673) describes a method for making a structure having a continuously variable geometry into a "material" but is silent as to what material is actually used. Vlannes' also discloses that the utility of the invention is drawn to providing "optical elements." The Examiner has combined the teaching of Vlannes ('673) with that of Brady, et al. ('797) in order to find the use of silicon in that the Examiner asserts that it "*would have been obvious to one of ordinary skill in the art to use a silicon substrate for the optical element in the method of Vlannes because Brady teaches that silicon is a known material for use as a substrate for an x-ray mask.*"

Applicant questions how the x-ray mask taught by Brady ('797) be defined as an optical element of the kind described by Vlannes ('673) which is drawn to a diffraction grating. However, Applicant's Claim 12, now amended, recites a "three-dimensional metal structure embedded in a silicon substrate", wherein that structure is a body filling cavities that have been etched into the silicon substrate. In contrast, Vlannes ('673) merely teaches "coating" the etched structure with an "optional" thin metal or dielectric film (col. 6, lines 39 – 51). No attempt is made to either teach or suggest a three-dimensional structure embedded into a silicon substrate and flush with a top surface of that substrate. Moreover, attempting to modify Vlannes ('673) to do so would defeat its stated utility as a diffraction grating.

Applicant, therefore, argues that by amending his Claim 12 to include the limitations of -- a three-dimensional metal structure embedded into said silicon substrate and about flush with said top surface --, now recite an invention whose *structure* is neither taught nor suggested by

Vlannes ('673) in that Vlannes ('673) does not teach "embedding" a metal structure into and flush with a top surface of a silicon substrate. As such Applicant asserts that Vlannes ('673) provides no support for finding *prima facie* obviousness under MPEP §2143, with or without the combined teaching of Brady, et al., ('797) since not all of the limitations of Applicant's Claim 12 are disclosed or suggested by either or both of the references. Finally, because all remaining claims depend ultimately from amended Claims 12, now shown to be unique and not disclosed or suggested by the prior art, they too must be unique since, by definition, dependent claims merely narrow the scope of the parent claim.

Applicant consequently asserts, that he has overcome the rejection under 35 U.S.C. §103(a) regarding Claims 12 – 14, 16, and 17 – 23 in that he has amended Claim 12 to claim an invention neither described nor suggested by the prior art. Applicant, therefore, respectfully requests the Examiner to reconsider and withdraw his rejection of Claims 12 – 14, 16, and 17 – 23 and pass these claims to allowance.

***Examiner's §10 – 11***

Examiner has rejected Claims 21 – 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joshi as applied to Claim 19 above, and further in view of Shepela (U.S. Patent Serial Number 6,060,387), in that Examiner asserts:

*"The reference discloses depositing tungsten using CVD and does not disclose using electroplating, electroless deposition, thermal or particle vapor deposition or sputtering. Shepela teaches that tungsten is also known to be deposited using sputtering, electroplating or electroless deposition (col.3, 55-59). It would have been obvious to one of ordinary skill in the art to deposit the tungsten layer in the method disclosed by Joshi using sputtering, electroplating or electroless deposition instead of CVD because Shepela teaches that these are all known deposition methods for tungsten."*

Regarding Claims 21 – 23, Applicant again thanks the Examiner for her remarks but again respectfully disagrees with her conclusion.

Applicant notes that Claims 21 – 23 each depend from Claim 12 now shown to be unique in view of Joshi, et al. ('879) in that that Joshi, et al. ('879) does not teach every element of the

claimed invention, and that the structures disclosed by the reference are not the same structures described by the Applicant's disclosure. As such, Joshi, et al. ('879) also fails as a reference against Claims 21 – 23 whether combined with Shelepa ('387) or not.

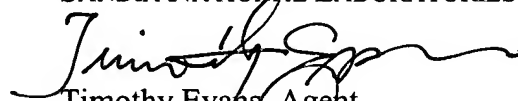
The Applicant, therefore, respectfully asserts that he has overcome the rejection of Claims 2 – 23 under 35 U.S.C. §103 by clearly distinguishing his invention over Joshi, et al. ('879) in that Joshi, et al. ('879) does not recite every element of the instant claim. Consequently, Applicant respectfully traverses the Examiner's rejection on the basis of MPEP §2143 and respectfully requests that the Examiner to reconsider and withdraw his rejection and pass this claim to allowance.

### CONCLUSION

In summary, the Applicant respectfully asserts that a *prima facie* case for anticipation under 35 U.S.C. §102(b) and obviousness under §103(b) has not been made. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 12, and 17 – 23 and earnestly solicits allowance of this application.

This response is, therefore:

Respectfully submitted by,  
SANDIA NATIONAL LABORATORIES

  
Timothy Evans, Agent  
Registration No. 41,013

P.O. Box 969, MS 9031  
Livermore, CA 94551-0969  
Telephone (925) 294 - 3690

### Attachments

Information Disclosure Statement under 37 C.F.R. §1.97(c)  
Form PTO-1449 "List of Patents and Publications for Applicant's Information Disclosure Statement"  
Form PTO SB/17 "Fee Transmittal"  
Chou, et al., "High-resolution and high-fidelity x-ray mask structure employing embedded absorbers"



**CERTIFICATION UNDER 37 CFR 1.8**

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the U. S. Postal Service on **MARCH 8, 2005**, in an envelope as First Class Mail addressed to: Mail Stop Non Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

Date of Deposit: 3-8-05

Anna Jimenez  
Person Making Deposit

Anna Jimenez  
Signature

**Attachments**

Information Disclosure Statement under 37 C.F.R. §1.97(c)  
Form PTO-1449 "List of Patents and Publications for Applicant's Information Disclosure Statement"  
Form PTO SB/17 "Fee Transmittal"  
Chou, et al., "High-resolution and high-fidelity x-ray mask structure employing embedded absorbers"